JPRS 74622

23 November 1979

USSR Report

ECONOMIC AFFAIRS

No. 899

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50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. JPRS 74622	2.	3. Recipient's Accession No.
4. Title and Subtitle USSR REPORT: ECONOMIC AFFAIRS, No. 899			5. Report Date 23 November 1979 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address As above			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This serial report contains information on recent administrative plans, changes, and policy trends, items on the state of the national economy, significant and representative comments and statistics on principal industrial sectors.

17. Document Analysis a. Descriptors

USSR
Economics

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group 5C

18. Availability Statement Unlimited Availability Sold by NTIS Springfield, Virginia 22161	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 35
	20. Security Class (This Page) UNCLASSIFIED	22. Price

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CONTENTS PAGE

RESOURCE CONSERVATION MEASURES PLANNED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 8, Aug 79 pp 81-88

[Article by I. Pashko, honored metallurgist of the RSFSR and candidate of economic sciences, and V. Pavlov, candidate of economic sciences and docent: "Planning the Indicator of Materials-Intensiveness"]

[Text] Under the conditions of developed socialism and the technological revolution, which are distinguished by a decrease in the share of the gross national product represented by live labor and an increase in that of embodied labor, the problem of materials-intensiveness is acquiring great significance, since reducing the material requirements of production would provide great opportunities for economy in expenditures of live labor and capital investments. The major objective of the socialist economy in the 10th Five-Year Plan is the fuller use of our abundant national economic reserves, the considerable enhancement of national production efficiency and the improvement of the quality of work in all areas of the national economy. The reduction of materials-intensiveness and the conservation of material resources will be of great significance in the attainment of this goal. Material expenditures account for around 55 percent of the gross national product and almost 80 percent of the cost of industrial production. The significance of this problem for the national economy, as pointed out in 25th CPSU Congress materials, is constantly increasing in connection with the growth of production volumes and the increase in the total quantities of crude and raw materials, fuel, energy, semimanufactured items, components, auxiliary materials and fixed productive assets involved in the production process. At the same time, the augmentation of the social productivity of labor is increasing the relative share of embodied labor in the cost of production. For example, between 1932 and 1975 the proportion accounted for by raw materials, fuel and energy in expenditures per unit of industrial product rose from 52 percent to 74.4 percent. For this reason, the conservation of embodied labor and reduction of materials-intensiveness are acquiring special significance.

The need to reduce proportional material expenditures in the social product is dictated by the scarcity of some natural resources and by the fact that many of them come from non-renewable sources. Materials-intensiveness is an economic category which is a major component of the total impact of national

production. If material requirements are, for example, three times as great as capital requirements, this affects the growth rates of production and national income and, in particular, the status of capital investments, whereas a reduction of 1 billion rubles in material requirements saves 6 billion rubles in capital investments.

The reduction of materials-intensiveness is an essential condition for more efficient national production, lower capital requirements and reduced labor expenditures. There is a close connection between the indicators of national production efficiency--labor-, capital- and materials-intensiveness. The lower the materials-intensiveness of the national product falls, the higher national income growth rates will rise.

The planning of materials-intensiveness presupposes the disclosure of massive production reserves resulting from technological achievements, the improvement of designs and technology with respect to materials conservation, changes in the sectorial and intersectorial structure, the efficient and economical use of primary raw materials and secondary resources and the improvement of the economic mechanism which stimulates the effective utilization of resources. The reduction of materials-intensiveness is one of the forms taken by the law of time conservation discovered by K. Marx. The higher the level of social labor productivity rises, the richer the society will be. For this reason, any kind of economy in the society ultimately saves time and expenditures of live and embodied labor.

In connection with this, the implementation of the law of the rising productivity of social labor is acquiring great significance. When we describe the mechanism governing its functioning, it is necessary to point out the importance of such processes as the intensification of social division of labor, the rise in technical equipment levels, the substitution of embodied labor for live labor and the consequent conservation of total expenditures of social labor.

The insufficient investigation of theoretical aspects of the materials-intensiveness of social production does not allow for improvement in the indicator of labor productivity, since existing methods for its calculation are inadequate and, therefore, impede effective production management. Enterprises often augment the productivity of live labor through unjustified increases in expenditures of past labor, embodied in crude resources, raw materials, fuel, energy and purchased semimanufactured items and components.

In recent years, more attention has been paid in economic science and practice to such indicators as the conditional net product, the net product and the normative net product.

In our opinion, the inclusion of the indicator of normative net production in the group of planned indicators will simultaneously necessitate the planning of materials-intensiveness, since the "net product," which reflects. by its economic nature, expenditures of live labor and profits, does not in

itself include materials-intensiveness. Moreover, it is important to know not merely how something is being done, but also what is being done and what kind of material resources are being utilized in the process. Materials-intensiveness primarily depends on the type of product, the manufacturing technology, production methods and the organization of production.

If the indicator of net production is used without any planning of materials-intensiveness, it will be impossible to control the actual productivity of live labor and conservation of material resources, as they will merge into a single indicator--the productivity of social labor. We must agree with V. M. Ivanchenko that the normative net product does away with one type of "dubious advantage" but thereby gives rise to another. Moreover, if the value indicator determining capital formation is taken to be production volume in tons, it will objectively stimulate a rise in materials-intensiveness, whereas an indicator expressed in terms of work hours will stimulate labor-intensiveness.[1]

As an economic category, materials-intensiveness has certain distinctive objective laws, indicators and stimuli, the correct use of which will promote the conservation of materials as the economy develops. This means total centralized norming and recording of material and technical resources utilized in production, the coordination of natural and cost indicators, the merging of national economic and individual interests in the more efficient use of resources, the institution of more powerful incentives for economy and the imposition of penalties for the overexpenditure of material and technical resources. Besides this, to heighten worker interest in the conservation of material and technical resources, it will be necessary to create a special fund, the basis of which will be the savings derived in material resources, with deductions rising as high as 50 percent of the total value of conserved resources for the payment of bonuses. The penalties for the overexpenditure of resources should not only affect enterprise budgets, but also material incentive funds, and it would be even more correct to establish personal liability for overexpenditures. At present, penalties of this kind are being imposed with increasing frequency by the USSR Committee of People's Control. For example, an investigation showed that the Soyuzrezinotekhnika and Soyuzshina all-union production associations had not organized the necessary work to institute stronger conservation measures and were not using scientifically substantiated norms for the expenditure of crude resources and materials and the more complete processing of secondary resources. The committee reprimanded some ministerial administrative personnel and collected a monetary fine from enterprise managers. The effect of these penalties could also be enhanced by assigning the chief accountants of enterprises, associations and organizations more responsibility for keeping records of the efficient use of resources.

When materials-intensiveness is being calculated, the category of material expenditures should include all material and technical resources which have been completely consumed during the period in question and whose value has been transferred to the product.

From the standpoint of the category of materials-intensiveness, the division of material resources into basic and auxiliary resources is of no fundamental value.

This approach to material and technical resources gives rise to the need for economy in each subsequent technological stage: as, for example, in the cotton, wool, silk, linen and knitwear subbranches--cotton fiber, various types of yarn, chemical fibers, dyes, water, fuel and energy resources, etc.; in the clothing industry--all types of fabric, accessories, auxiliary materials, fuel and energy resources, etc. Consequently, in each stage of production in the total national economic complex, any type of material or technical resource should be regarded as raw material, which, "although already a product..., must nonetheless undergo an entire series of different processes in which it, in constantly changing form, functions each time as raw material once again, right up to the last process, from which it emerges as a finished vital necessity or finished means of labor."[2]

From the standpoint of the category of materials-intensiveness, the approach to the particular portion of material and technical resources involved in the creation of the social product, which is frequently called the "recalculated quantity" in economic science and practice, undergoes a fundamental change. We must agree with S. I. Lushin that the "recalculated quantity" is an unsuitable name for the intermediate product and that it cannot be excluded from the social product or any other, since national economic balance requires an indicator of the social product which completely reflects all economic connections in the branches of the national economy, backed up by the labor collectives of socialist enterprises, distinguished by a communist characteristic--thrift.[3] It should be noted that the material and technical resources acquired by enterprises for production purposes are paid for with enterprise funds earned from the sale of products, but even consumers often do not object, under present conditions, to the acquisition of new materials or components distinguished by their high cost, as these high prices are included in the plan for them and their suppliers. The losses incurred by the national economy as a result of the inefficient use of material and technical resources, regardless of whether they are basic or auxiliary, have an identically negative effect on the economy.

In our opinion, it is necessary to elucidate the question of more efficient use of purchased semimanufactured items and components, since the incorrect belief that it would be impossible to economize on these types of material and technical resources exists. For example, Yu. Krotov suggests that the category of material expenditures cover only materials and exclude purchased parts and components because it is supposedly absolutely impossible to economize on these in production. He also doubts the accuracy of including the cost of fuel and energy in total material expenditures when materials-intensiveness is being calculated, and categorically asserts that auxiliary materials should not be included in total material expenditures. We cannot agree with these statements for the following reasons. All types of material resources are completely included in the gross national product and, for this

reason, it is incorrect to propose the exclusion of purchased parts and components, fuel and energy and auxiliary materials from the category of material expenditures when materials-intensiveness is being calculated.

Materials-intensiveness includes many varied factors which can decrease or increase material requirements, and this means that its dynamics must be analyzed factor by factor. The expert appraisals conducted by USSR Gossnab of ministerial and departmental plans and requisitions are quite productive, ensuring a reduction in expenditures of such scarce purchased components as rolling bearings, cable, low-voltage electrical equipment and so forth. Moreover, this savings amounts to hundreds of millions of rubles. For example, the mere replacement of pumps requisitioned for a particular type of assembly with parts that were less productive but consistent with existing norms produced a savings of 1.5 million rubles. An even greater savings results when branch research institutes responsible for the development of particular products oversee the application of their discoveries. After all, the correct choice of items is one of the major conditions for increasing the length of their service life. For example, in 1977 the Vladimir Scientific Research, Design and Technological Institute of Electrical Machine Building rejected around 20 percent of the plans submitted for its approval, since the electrical engines included in the designs by clients were either unsuitable, in terms of power, operational conditions or mechanical characteristics, for the projected machines and devices, or had considerably different service lives, in connection with which the resources of the electrical engines would not be completely utilized. As we know, these engines are mainly used as components in machine-building branches. The standardization of components also considerably enhances the efficiency of their utilization. It is no coincidence that brigades at the nation's leading enterprises, such as the Volga Motor Vehicle Plant, work according to set norms for the expenditure of basic materials and components in addition to production output standards measured in norm-hours, wages and quality specifications.

It is understandable that expenditures on purchased components and semi-manufactured items (just as, incidentally, those on basic materials) depend on the variety of structural items used. It has been established, however, that the optimization of expenditures of labor, funds, materials and time during the preparation of production produces a sizeable savings. For example, experience has shown that the use of different plans, designs and purchased components for a particular item can reduce initial overhead costs by 15-20 percent and save the national economy several billion rubles.

Analysis indicates that the use of comprehensive materials-intensiveness normatives in the practice of economic management on all levels of planning, particularly on the level of USSR Gosplan, could produce a greater impact than the further breakdown of normative information. For example, whereas centralized calculations of the material requirements for machine building once only covered 600 items, they now cover 9,000. When annual plans are compiled, the main computer center of USSR Gosplan uses 270,000 material

expenditure norms.[4] This detailed calculation of items makes it possible to take structural changes in the output into account. But the efficacy of these calculations can only be enhanced if production volumes are coordinated with these 9,000 items in terms of product assortment. This work can only be performed by USSR Gossnab in conjunction with ministries and departments and their industrial production associations. Therefore, during the first stage of the pre-planning period, planning agencies should base their computations on comprehensive production volume and materials-intensiveness indicators, and only later determine the final variant of the national economic plan with consideration for the precise assortment-related product requirements and limits on material and technical resources, with a breakdown for each level of planning.

The coordination of calculations on all levels of planning in regard to the reduction of overhead costs and the modification of norms governing the expenditure of, and demand for, material and technical resources in natural and cost terms will necessitate the construction of a natural-cost matrix of materials-intensiveness, covering all links of the national economic mechanism.

Reserves for the reduction of materials-intensiveness are abundant in all branches of the national economy. For example, the scrap metal indicator is still high in machine building, and the final product--the machinery--sometimes uses 20-25 percent more metal than superior foreign models.

The reduction of the materials-intensiveness of machine building will depend largely on the broad-scale incorporation of production technology involving little or no waste. Moreover, the rapid implementation of existing inventions and discoveries could produce a considerable savings. An analysis of materials-intensiveness in branches of the national economy indicates that there are still tremendous possibilities for conservation. For example, according to the data of the All-Union Scientific Research Institute of Gas Utilization in the National Economy and of Underground Storage of Petroleum, Petroleum Products and Liquefied Gas, for various technical, organizational and other reasons, there is an annual overexpenditure of 15 billion cubic meters of gas. Losses of fertilizer amount to an average of over 6 percent just at the storage bases of the State Committee for Agricultural Equipment, and if deliveries to agriculture are included, these losses are estimated at tens of millions of tons over a period of 5 years. Average losses of nutritional elements in fodder in connection with primitive methods of preparation and the unsatisfactory storage conditions on most farms amount to more than 20-30 percent for hay, haylage and silage. If these losses were to be reduced by at least half, the fodder balance of animal husbandry would increase by a minimum of 30 million tons of feed units. This quantity would be enough for the production of an additional 20-25 million tons of milk or 2.5-3 million tons of meat (slaughter weight). It will take 12 billion rubles in capital investments to increase the average annual agricultural product by 1 billion rubles in the near future. This testifies to the national economic significance of a reduction in the materials-intensiveness of agricultural production.

In the construction industry, above-norm losses of construction materials are estimated at approximately 45 million tons. In transportation, total inefficient shipments amount to around 100-133 billion ton-kilometers, and doing away with these would reduce transport costs by 400-500 million rubles.

At present, when annual and five-year national economic plans are being drawn up, all indicators are calculated in comparison to base indicators. For example, according to the data of the USSR Central Statistical Administration, during the past 2 years of the current five-year plan the reduction of materials-intensiveness has resulted in a savings of around 5 billion rubles in crude resources, materials, fuel and thermal and electrical energy, while the level of materials-intensiveness in 1977 was 573 rubles for each 1,000 rubles of gross national product, as compared to 580 rubles in 1975.

In 1978 the materials-intensiveness of the gross national product was lower than in 1977, as a result of which additional crude resources, materials, fuel and other articles of labor worth around 3 billion rubles were conserved, and the calculated level was 570 rubles for each 1,000 rubles of gross national product. Therefore, within 3 years of the 10th Five-Year Plan, the savings resulting from the reduction of materials-intensiveness in comparison to the 1975 level already amounted to around 10 billion rubles and exceeded the 5-year planned savings of 8 billion rubles.

The customary comparison of planned quantities with the base year, however, is not completely indicative of materials-intensiveness, since the base year was 1975, when there were tremendous agricultural losses due to bad weather. For this reason, the materials-intensiveness of the gross national product (in existing prices, including amortization) rose dramatically in 1975 to 580 rubles per 1,000 rubles (see table).

Year	Gross national product, billions of rubles	Material expenditures, billions of rubles	Materials-intensiveness of GNP, rubles/1,000's
1965	513	277	540
1970	643	354	550
1975	860	499	580
1977	943	542	573
1978	966	568	570

The reduction of the materials-intensiveness of the gross national product in 1978 was largely due to inter- and intra-sectorial structural changes. For example, although industrial production volume as a whole increased 5 percent, rates of development in the more materials-intensive branches were lower: 4 percent in light industry, 2 percent in the food industry

and 3 percent in the meat and dairy industry--that is, the particular industries in which materials-intensiveness has a considerable effect on the materials-intensiveness level of industry as a whole. The internal reserves at the disposal of our economy, however, have not been completely utilized as yet.

Calculations show that a reduction in materials-intensiveness accompanied by more comprehensive centralized assignments of norm reduction can produce a savings estimated at tens of billions of rubles (for example, over 21 billion rubles in 1980 in comparison to 1975) and a savings of hundreds of billions of rubles in capital investments.

The reduction of materials-intensiveness is a tremendous reserve in our economy, which is still not being sufficiently utilized. In-depth analysis and study of materials-intensiveness as a major economic category and an indicator of national production efficiency indicate that the level of materials-intensiveness is extremely high in the first subdivision of social production, industries of group A, particularly the metallurgy and machine-building complex. Without a considerable reduction in this level, it will be impossible to plan and achieve higher rates of national economic development and national income growth.

In order to increase the efficiency with which material and technical resources are used in industrial branches, it will be necessary, in our opinion, to include plans for the materials-intensiveness of industrial production in the plans for economic and social development, the plans of industrial branches and so forth. It would be expedient to initiate this practice in several industries where the appropriate normative base has been established and experiments have been conducted in the use of methods for planning the materials-intensiveness of industrial production. Within the framework of this planning process, all questions connected with the efficient use of material and technical resources can be resolved collectively and the factors contributing to their reduced expenditure can be determined.

Planning for the materials-intensiveness of production on all levels of economic management will represent a carefully worked out system of interrelated measures of a technical, economic and organizational nature. The transition to this planning will ensure the more effective supervision of resource consumption, will provide new stimuli and precise guidelines for socialist competition for economy and thrift, and will provide for the accelerated realization of 25th CPSU Congress decisions concerning the enhancement of national production efficiency and the more economical and efficient use of all resources in the possession of our society.

A system of scientifically substantiated progressive norms and normatives, particularly individual standards, approved by planning agencies, will be of great significance in the reduction of materials-intensiveness. Only a considerable reduction will alleviate the tension in the current balance of

material resources in the national economy, which is now distinguished by excessively high expenditures of resources in the branches extracting crude resources and materials, the processing branches and the sphere of consumption. This need to conserve materials should serve as the point of departure in scientific research and in the making of project planning and technical decisions.

In the present stage of our economy's development, the question of reorganizing the production system in all branches of the national economy with a view to the conservation of materials and the further enhancement of production efficiency and improvement of the quality of work has economic and social implications. This will necessitate the fuller use of organizational reserves which do not require large capital expenditures.

In our opinion, the level of national economic materials-intensiveness, as well as levels of other links in the national economic mechanism, should be calculated and established with a view to the necessity for the use of all existing production reserves, so that the drafting of state annual, five-year and long-range plans will be accomplished by means of their comparison not only with indicators of the base period, but also indicators which should be achieved as planned through the interrelated and coordinated effects of all economic, technical, organizational, legal and other measures. It is only this, the use of the advantages of the materials-intensiveness category in planning, that will ensure the fuller realization of the advantages of planned socialist economic management and the achievement of higher rates of national economic growth, which will allow for the subsequent implementation of the Communist Party's course of promoting a rise in the material and cultural standard of living for the people.

FOOTNOTES

1. V. Ivanchenko, "The Stimulating Role of the Plan Indicator," EKONOMICHESKAYA GAZETA, 1978, No 20, p 15.

2. K. Marx and F. Engels, "Works," vol 23, p 193.

3. S. Lushin, "Balance of the Production and Utilization of the Social Product and National Income," Moscow, MINKh imeni G. V. Plekhanov, 1976, p 11.

4. N. P. Lebedinskiy, "The Automated System of Plan Computation," EKONOMICHESKAYA GAZETA, 1978, No 29, p 17.

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CREDIT LEVERS IN ECONOMIC MANAGEMENT

Moscow EKONOMICHESKAYA GAZETA in Russian No 40, Oct 79 p 5

[Text] In the harmonious system of measures to perfect the economic mechanism great attention is being given to the further increase in the effectiveness of the credit mechanism in the economic stimulation of production and capital construction and to the improvement in the organization of calculations in the national economy.

The Perfection of Credit Planning

In the aggregate financial balance which goes into the composition of the five-year plan, provision must be made for the guarantee of financial resources, including credits of the USSR State Bank (Gosbank), all measures being planned, and also the development of necessary reserves. USSR Gosbank credits constitute one of the most important sources of the formation of producer goods and circulating capital in the economy. Taking this into account, the USSR Gosbank will have to develop and present to the USSR State Planning Commission (Gosplan) calculations of long-term and short-term credits for the five-year plan (with a breakdown by years).

These new situations confront the USSR Gosbank with complex and responsible tasks, the solution of which requires a significant increase in the level of credit planning, an improvement in the economic analysis of credit relations, a more thorough study of economic phenomena and processes that go on in the economy and the finances of production associations, enterprises and industries of the national economy.

The composition of five-year and annual plans for credit extension makes it possible to coordinate them more closely with the plan of economic and social development of our country, and also with the state budget, the financial plans of enterprises, organizations and their higher links.

The USSR State Bank, which is an organ of statewide accounting and control, develops its credit relations with socialist enterprises differen-

tially, depending on the results of their work: the extent to which they fulfill the production plans and the saving plans, the condition of the economic structure and finances, the on-schedule and complete fulfillment of obligations to Gosbank in regard to the repayment of loans. Enterprises that are doing good work receive credit on more favorable terms, but enterprises and associations which do not fulfill the basic plan indicators and their obligations to the bank are subjected to measures of economic and organizational influence in the form of the restriction of the right to credit and the collection of increased payments for the use of bank loans.

During the past years, a great deal has been done to perfect a differentiated regime of credit extension in the direction of a comprehensive and full calculation of the efficiency of social production and the contribution of every socialist enterprise to its increase. The indicators of a differentiated approach change, taking into account the perfection of the mechanism of planning and the economic stimulation of production.

At the present time Gosbank faces further serious work with regard to the perfection of the system of appraisal indicators of a differentiated regime of credit extension already on the basis of criteria established by the decree of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979. This concerns, above all, the calculation of plan fulfillment in regard to the deliveries of products destined for production and technical use and consumer goods according to the products list (in the product assortment) and within the terms in conformity with the contracts (orders) entered into, the increase of labor productivity and the quality of production, the growth of profit (and in individual sectors--the lowering of production costs).

A differentiated regime of credit extension of enterprises and associations depending on the results of their work and the concrete contribution to the increase in the efficiency of social production secures the link between bank credit extension and the organization of cost accounting. An important instrument for influencing the cost accounting interests of the enterprises and associations that are to be granted credits is the loan percentage--the percentage rate for the utilization of the credit.

During the past few years there has been some increase in the level of percentage rates and their wider differentiation depending on the type of loans and the observance of credit discipline by state organs. However, the possibilities of economic influence through the loan percentage are still not being used sufficiently.

In connection with this, the CPSU Central Committee and the USSR Council of Ministers have charged the USSR Gosbank, with participation of the appropriate ministries and departments, to prepare the draft of a decree of the USSR Council of Ministers on differentiated percentage rates for

the use of bank credits. The object of the task is to coordinate the percentage rates closely with the special purpose designation, the reasons behind the demand for credit, the length of its use and the promptness of its return, and also with the assessment of the level of profitability of the individual sectors of the national economy.

For the Acceleration of Technical Progress

The stimulating role of credit in the acceleration of scientific-technical progress, in the perfection of the sectorial structure of industry, in the improvement of the technical-economic indicators of production, is acquiring ever greater significance in the activity of Gosbank. In 1978, 1,423.7 billion rubles of short-term credit were granted. During the three years of the current five-year plan, short-term credit investments in the economy of the country have increased by 23.6 percent. Moreover, in the machine building sector of industry during the past three years of the 10th Five-Year Plan credit investments have increased by 43.2 percent with a growth of credits in industry as a whole of 22.7 percent. During the same period the credits granted to associations and enterprises for assimilating newly commissioned enterprises, shops, technological processes, and also the assimilation of production of new kinds of products and an increase in their quality, increased by 73.9 percent, their volume on 1 January 1979 exceeded 1.6 billion rubles.

The decree of the CPSU Central Committee and the USSR Council of Ministers provides for comprehensive measures aimed at the further acceleration of scientific-technical progress and the expansion of the output of new high-quality production. A certain role has been assigned to credit measures of stimulation.

In conformity with the above-mentioned decree, USSR Gosbank credits for the implementation of highly effective measures will receive extensive development. In particular, the banking system will extend credit to ministries and departments for operations to be financed at the cost of means from a single fund for science and technology when the time of receipts into this fund and the volume of expenditures taken out of it do not coincide. Scientific-production and production associations (enterprises) will receive credit for the implementation of highly effective measures on the condition that they will be realized in shorter periods of time than provided for by the plan.

Gosbank credits are also called upon to play an important role in the realization of highly effective measures concerning the development of science and technology which are not envisaged in the plan. The repayment of credit and the percentages for it will take place in the course of two years at the expense of means from a single fund for science and technology development. Said credit will be granted to associations and enterprises with guarantees by the ministries, departments, or all-

Union (republic) industrial production associations.

In order to increase the role of economic levers and stimuli in expanding the output of high-quality production and the transition of associations and enterprises to the output of new products, USSR Gosbank has been authorized to grant credit to production associations (enterprises) for carrying out--above the limit of state capital investments--highly effective measures with regard to the output of new production and the increase in the quality of articles produced on the condition that the expenditures and loans will be repaid within a period of up to two years at the expense of additional profit. In this way credit appears as an effective stimulus for the development of scientific-technical progress. The role of USSR Gosbank credit in capital construction is also growing.

Credit for the Production of Goods for the People

Of great importance in the measures of the party and the state is the expansion of the production of consumer goods, the improvement of everyday services to the population. The USSR Gosbank will grant credit to production associations and enterprises for the execution of highly effective measures directed at the solution of the aforementioned tasks over and above the limit of state capital investments. An obligatory condition here is the repayment of expenditures and the loan within a period of up to two years at the expense of additional profit. In the determination of the period and the source of the repayment of the credit, a turnover tax of up to 50 percent on the sale of consumer goods will be calculated which are produced by virtue of the implementation of the measures for which credid is being extended.

Problems of the more complete satisfaction of the demand of the population are closely connected to the mechanism of money circulation. To guarantee the stability of money circulation in the five-year and year balances of money incomes and expenditures of the population, it is planned that necessary reserves will be provided, and in connection with their development the USSR Gosbank has been charged with submitting to the USSR Gosplan the necessary estimates and proposals in regard to the balances of the money incomes and expenditures of the population.

The planning of money circulation is based on the planning of production and the distribution of the social product, therefore various indicators of the national economic plan are reflected in the balance of the money incomes and expenditures of the population.

The planning and the regulation of money circulation are aimed at guaranteeing the growth of money turnover and the money mass in a volume which is necessary for the continuous process of reproduction on an expanded scale. Moreover, the objects of planning money circulation are the volume and structure of the cash turnover and the money mass necessary

circulation.

The perfection of the economic mechanism calls forth the necessity of improving the method of calculation in the direction of balancing the proportions of money circulation and the determination of the necessary volume of the reserve. In the process of formulating the plan and in the course of its execution, the complete balance must be secured of the money incomes and expenditures of the population in conditions of an increase in the material well-being of the workers, the quantitative and qualitative growth of demands and the possibilities of their satisfaction by virtue of the development of the production of consumer items.

Through their characteristic means, the institutions of the bank must strengthen their influence on trade and industrial enterprises in agreeing to 5-year contracts among them concerning the delivery of goods in the direction of the fuller satisfaction of the demand of the population for consumer goods, the increase in responsibility on the part of the production associations (enterprises) for the fulfillment of the orders of the trade organizations, and the responsibility of the trade organizations for these orders.

New Order of Calculations for Production

The realization of cost accounting relations among production associations, enterprises and organizations takes place with the active utilization by them of credit and the appropriate forms of calculations.

At the present time, 67 percent of the volume of all payments for goods and material values as well as services rendered are transacted with the assistance of bank credit.

Guided by the directives of the 25th CPSU Congress concerning the necessity of improving the condition of calculations in the national economy and strengthening the influence of economic levers and stimuli, including credit, on the ultimate national-economic results, the institutions of the bank began to make active use of the credit accounting mechanism in order to increase the efficiency of production and the quality of work.

During the last years in conditions of expansion of maneuverability in the use of working capital in many sectors of the economy, there has been an increase in the payment discipline and the mutual overdue indebtedness of state organs has been reduced. At the present time, 94.5 percent of the accounting documents are paid on schedule and 5.5 percent are overdue. Thus a number of enterprises still continue to experience financial difficulties connected with the violation of terms of payment.

Establishment as one of the appraisal indicators of the fulfillment of the plans for production deliveries requires the perfection of the organi-

zation of clearing operations. These questions have been the subject of detailed discussions in the press, in particular in EKONOMICHESKAYA GAZETA, in the course of which a definite approach to the solution of the problem was developed.

To secure prompt settlement of accounts for production delivered in conformity with contractual agreements and to increase the responsibility of buyers in regard to the observance of payment discipline, provision is made that, in the case of violation of the term of payment and the temporary lack of means on the buyer's part, the accounting documents accepted by him will be paid by the banks at the expense of a loan granted to the buyer, which must be repaid within a period of 60 days in the order of priority established for the payment of commodity-material values and services, with a penalty of 5 percent per annum for the use of this credit.

In the case the credit is not repaid by the due date, the payer (which is very important and constitutes a new provision) retains the right to receive credit in the future to pay the accounting documents of suppliers, but at an increased loan percentage.

This provision gives the buyer the possibility, prior to paying the accounting documents, to conduct the necessary check on the observance, by the supplier, of the conditions of the delivery contract regarding the volume of the delivery, the assortment of the delivered production, its quality and the terms of delivery, but also creates a reliable financial source for the payment of accounting documents of suppliers in the form of a credit in case of the temporary lack of necessary funds in the current account of the payer.

It is important to note that only accounting documents accepted by the buyer will be paid at the expense of a payment credit.

Regardless of the fact that at the present time much attention is given in the work of Gosbank institutions to the supervision of the observance, by suppliers as well as by buyers, of the rules governing the completion of clearing operations, this problem has not yet been fully solved by Gosbank. The following figures testify to this.

During 1976-1978, Gosbank institutions verified the marketable value of accounting documents presented for payment in the total sum of more than 28 billion rubles and, in addition, in the case of 66,000 suppliers bills for unreceived goods and services, forwarded to payers, were revealed in the sum of 731 million rubles. This means that the control aspect of the accounting mechanism requires perfection.

Gosbank institutions accept refusals to accept payment demands in connection with poor-quality or incomplete production and goods, their nonconformity to standards, technical conditions and contracts, which are

based not only on the orders of the State Inspection Service (Gosinspektsiya) with regard to the quality of the goods and trade, but also on the orders of the All-Union State Committee for Standards (Gosstandart SSSR) --which, of course, reinforces the rights of users. By the way, the latter are obligated, without reservations or conditions, to impose sanctions for the violation of contractual obligations with regard to deliveries. Unfortunately, there are quite a few instances when these sanctions are not applied. Such mutual all-forgiving does not serve to strengthen plan discipline.

In extending credit under accounting documents en route the volume of credit to suppliers is reduced by the percentage of refusals to accept on the grounds of poor-quality production and by the percentage of rejected production.

The allocation of credit for accounting documents en route to suppliers is reduced if the trading organization, to which they supply goods, are subjected to attempts to exert influence on them in the form of the reduction of credit extension for the payment of goods which are not in demand among buyers. All of this must promote the adoption of measures on the part of the state organizations which guarantee an increase in the quality of the output produced by them.

The extension of payment credit for settling only the accounting documents that have been accepted by the buyers will stimulate further the strengthening of contract discipline in the economy, the increase in the quality of production sold, and will also promote the most rational use of credit resources, not permitting them to become involved in the defrayal of plan violations with regard to the delivery of production by suppliers.

The strengthening of the role of credit must promote the creation of the most favorable conditions for accounting, the further strengthening of plan-established economic links, the continuous functioning of the entire economic mechanism.

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SPEEDING UP SCIENTIFIC-TECHNICAL PROGRESS

Moscow EKONOMICHESKAYA GAZETA in Russian No 42, Oct 79 p 6

[Text]* The development of science and the scales of the practical use of its results are at present becoming one of the determining factors in the increase of the efficiency of the national product. A powerful scientific-technical potential has been created in our country. Research and the development of new technology are being carried out by thousands of scientific research and higher-educational institutions, tens of thousands planning and design organizations and their subdivisions, more than 200 scientific production associations. More than 4 million people are working in the area of science, including 1.3 million scientists. Expenditures for science in the country amount to approximately 5 percent of the national income.

In the conditions of an unfolding scientific-technical revolution, the time between the origin of a scientific idea and its realization has sharply decreased. During the past 20 years, the average percentage of annual renewal of production rose 3.5-4 times, and in some very progressive sectors 6-7 times. The savings from the introduction of new technology measures during the years of the 9th Five-Year Plan amounted to 12.3 billion rubles and during the 10th Five-Year Plan will grow almost 1.5 fold. Almost 3/4 of the growth of labor productivity is secured through the introduction of new technical means and progressive technological processes.

New Developments in th Planning of Science and Technology

The decree of the CPSU Central Committee and the USSR Council of Ministers, adopted on 12 July 1979, provides for a large complex of measures aimed at the perfection of the management of science and technology, at the strengthening of the economic levers of speeding up scientific-technical progress.

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* The article published here is the tenth editorial on problems of the perfection of the economic mechanism. Previous articles were published in Nos 33-41 of the weekly.

One of the important directions is the further assimilation of the program-oriented method of planning the development of science and technology. Its utilization will promote the realization of a single policy in science and technology, the increase of the singleness of purpose in the work of the scientific research and the planning-design organizations, the reduction of the time required for the creation and assimilation of the achievements of science and technology.

In its essence, the program-oriented method is a qualitatively new form of planning, which is oriented toward the speeding up of the use of scientific-technical achievements, toward final national-economic results. The application of scientific-technical programs will allow better realization of the concentration of scientific forces, material and financial resources on the solution of large statewide scientific-technical problems, on the main directions of scientific-technical progress.

In the statewide system of planning, great significance is attached to the development of a comprehensive programm of scientific-technical progress during a 20-year period (by five-year plans). The development of this program is entrusted to the USSR Academy of Sciences, the USSR State Committee for Science and Technology, and the USSR State Committee for Construction Affairs. The program must be submitted to the USSR Council of Ministers no later than two years prior to the next five-year plan. It is envisaged that every five years necessary clarifications will be introduced and the program fpr the new five-year plan will be drawn up. In this way the continuity and uninterrupted nature of the planning of scientific-technical progress will be guaranteed.

The decree also provides for the development of special-purpose programs aimed at the solution of important scientific-technical problems and problems of the comprehensive utilization of natural resources. Such programs must envisage operations reaching from scientific research to the practical realization of the results, including the organization of serial production of new products and the introduction of progressive technology. These programs constitute the further development of medium-term programs (mainly on a five-year plan basis) which are in effect at the present time. The development of more than 200 programs concerning the solution of the most important scientific-technical problems is implemented in the composition of the State Plan for the 10th Five-Year Plan.

In addition, programs aimed at the solution of sectorial scientific-technical problems and the comprehensive utilization of natural resources will be developed. It is important to note that all programs envisaged by the decree are being elaborated within the framework of the statewide plans, and not in isolation from them.

The range of plan indicators of scientific-technical progress being confirmed is expanding. In the five-year plans of the ministries, associations and enterprises, in the section dealing with the introduction of

new technology, basic tasks are being established with regard to the fulfillment of scientific-technical programs, the development, assimilation and introduction of new, highly-effective technological processes and types of production, including with regard to enterprises and projects newly put into operation. It is also envisaged to establish basic indicators of the technical level of production and the most important kinds of output produced. New here is the introduction of the indicator: Economic effect from scientific-technical measures and the establishment of norms for the formation of a single fund for the development of science and technology (for the ministries).

The five-year targets are becoming more concrete in the annual plans in the sections dealing with the introduction of new technology and progressive experience. The tasks with regard to the elaboration, assimilation and introduction of new, highly-effective technological processes and kinds of production, as well as the fulfillment of scientific-technical programs, will be confirmed. New in the annual plans are the tasks with regard to the introduction of progressive experience in the sphere of technology, the scientific organization of labor, production, and management.

The reduction of the time needed for scientific research and the development and speeding up of its use in the national economy will be promoted by the formation, in the composition of the state five-year plans, of material and financial reserves for the needs of production, capital construction and scientific research work, and in necessary instances also of reserves of production capacities.

On Cost Accounting Basis

The speeding up of scientific-technical progress in many respects is determined by the activity of enterprises, scientific research and planning-design organizations, their economic interest in this matter. The decree of the CPSU Central Committee and the USSR Council of Ministers provides for a series of important measures to improve the economic stimulation of scientific-technical progress. In particular, projections call for the completion in 1980 of the transition of scientific research, planning-design, and technological organizations, model (experimental) enterprises, scientific production and production associations (enterprises) of the industrial ministries to a cost accounting system of work organization in the area of the creation, assimilation and introduction of new technology on the basis of orders and authorizations (contracts).

In the orders and authorizations (contracts), the final results of the operations being planned will be determined, including the economic effect on the national economy, the executors, the time limits for the execution of the operations in all phases--from the research to the introduction of the results in production, and also the necessary material resources, the sources and volumes of financing and material incentives.

It has been established by the decree that the volumes of expenditures for scientific research, experimental design and technological work must be determined in the five-year plans in percentages of the net product (standardized), and in some sectors--of the commodity production. The wage fund of the workers in the above-mentioned organizations will be calculated in percentages of the volume of expenditures for scientific research, experimental design and technological operations.

With a view to securing continuity and an increase in the comprehensiveness of planning and financing research, elaborations and operations in regard to the assimilation and introduction of new technology in production, the decree provides for the creation unified funds for the development of science and technology in the ministries and departments at the expense of deductions from the plan profit of the associations (enterprises) of an industry. These funds are earmarked for the financing of scientific research, experimental design and technological operations, for the reimbursement of expenditures connected with the development and assimilation of new forms of production, the introduction of methods of the scientific organization of work, and also for the financing of additional expenditures for the improvement of the quality of production and, which is especially important, increased expenditures during the first years of the assimilation of the output of new production. The unified is a carry-over fund, its means are not subject to removal and use for other needs. (Methodological instructions for the formation and use of the unified fund for the development of science and technology were published in No 39 of EKONOMICHESKAYA GAZETA).

The advantages of financing through a unified fund are supported by large economic experiments which have been carried out in associations, enterprises, scientific research and planning organizations of a number of ministries. Efficiency in the formation and utilization of a unified fund is attained, above all, through the unification of all sources of financing scientific-technical progress, which formerly had a strictly special purpose designation. The unified fund secures for the ministries great operational and management independence with respect to the distribution and redistribution of funds among the different phases of the creation and assimilation of new technology. The transition to a normative method of planning expenditures for science and the industrial assimilation of its achievements is also secured. The formation of a unified fund will also create favorable conditions for the comprehensive solution of scientific-technical problems, the concentration of financial resources on the most important directions of scientific-technical progress and their more effective utilization.

The financing of scientific research and experimental design work from the means of the unified fund made it possible to increase the specific weight of operations which guaranteed the creation of a scientific inventory in the electrotechnical industry for the period 1969-1978, approximately 2.5 times as large, in heavy machine building for the years 1972-1978 more

than 1.5 times as large, in the chemical industry for the same period--almost 4 times as large.

The cost of operations of an industrial character connected with the assimilation and introduction of new technology and realized at the expense of means from the unified fund must now be taken into account in the total volume of production with the extra charge of the standard profit according to the appropriate groups of articles. The solution of this problem will be promoted by the creation of conditons which guarantee the calculation of expenditures financed from a unified fund within the total volume of normative net or commodity production.

With the Calculation of the National-Economic Effect

Of great significance with respect to incentive in the speeding up of scientific-technical progress will be tne development in scientific research, planning-design, and technological organizations, by analogy with production associations (enterprises), of: a material incentive fund; a fund for social and cultural measures and housing construction; a fund for the development of organizations. The decree also calls for the payment of bonuses to the workers of scientific production and production organizations, scientific research institutes, and design offices for the creation of new technology, depending on the total economic effect actually received in the national economy from the utilization of the achievements of science and technology.

The analysis of scientific and planning-design organizations working on the basis of such a system shows that such a procedure guarantees the acceleration in the rates of increase in effectiveness resulting from the introduction of scientific-technical measures and the output of high-quality production. The annual growth of the national economic effect constitutes, for example, in the electrotechnical industry more than 20 percent, and in heavy machine building--approximately 5 percent. The share of production with the State Emblem of Quality in the total volume of commodity production exceeds all-union indicators in the electrotechnical industry almost by a factor of 4, in heavy machine building--by more than a factor of 2.

The rates of growth of the total annual economic effect derived from the assimilation and introduction of new technology in the electrotechnical industry for the years of the experiment grew almost by a factor of 4 and exceeded the rates of growth of the deductions into incentive funds. Also 4 times higher were the average yearly rates of increase of products of the highest quality in comparison with the rates of increase of the total volume of production in the industry. In the heavy and transportation machine building, the annual economic effect of new technology grew almost by a factor of 3, and the specific weight of the production of highest quality increased approximately by a factor of 3.5.

As a result of the transition to the new system, the time required for the execution and introduction of elaborations has decreased. In particular, in the Ministry of the Electrical Equipment Industry it decreased on the average by a factor of 1.5-2.

The decree of the CPSU Central Committee and the USSR Council of Ministers clearly sets forth the directions to be followed by industrial science in perfecting the mechanism of management toward strengthening and developing cost accounting in every conceivable way in this sphere of scientific activity.

In this respect, one of the most perspective and far-reaching measures is the instruction concerning the gradual conversion of scientific research, planning-design, and technological organizations to a system of accounting for work that is fully completed and accepted by the client instead of the payment for work in stages. It is proposed that this conversion be completed in the 11th Five-Year Plan.

It is known that at the present time the financing of scientific organizations was effected primarily through the opening of credit every quarter for the payment of all the expenditures being generated, and in the case of the execution of work in accordance with an economic agreement--by means of payment of an advance and subsequent accounting for the individual phases of the work. Thereby the process of work was paid, not the final results. In the case of unsatisfactory results there is some kind of system of sanctions, but it is not very effective since the expenditures have already been fully generated.

Under the new form of accounting with the clients, the organization of work of the sectorial scientific research institutes and design offices in this sphere come to approximate the accepted methods of work of the production enterprises: the client pays for the work only after he clearly sees the result obtained, can assess its conformity with the demands made by him.

The decree provides that the expenses of scientific organizations prior to the planned delivery of the work are defrayed at the expense of a bank credit within the limits of the means released to the client in connection with the transition to accounting without intermediate payments.

To strengthen the cost accounting methods of management through the activity of sectorial scientific research institutes and design offices, an experiment was started in 1977 in a number of research organizations in regard to the transition to the assessment of the activity of the organization from the indicator "volume of jobs completed" to the indicator "volume of jobs completed and delivered". In addition, the scientific

research institutions and design offices were allocated working capital in greater volume, and all the means covering their expenses and profits generated, they received from the client after completion and delivery of the work. Under such conditions of accounting, the scientific organization and every one of its workers are interested in the quick completion of the jobs since the financial position of the organization, the possibilities and dimensions of the economic incentive of the collective depend on this.

At the same time, the new procedure requires the more decisive removal of inadequacies in the organization of work of scientific and planning-design collectives, an increase in the responsibility of every specialist for the work ordered, the persistent attainment of progressive technical-economic solutions, the creation of new technology, whose level exceeds the best domestic and foreign achievements.

Taking into account the decisive role of machine building in the speeding up of scientific-technical progress, the decree introduces single premiums in the scientific production and production associations, in the enterprises and organizations of this sector, for the elaboration, assimilation, and mass output of especially important and highly effective equipment and machines, as well as for the creation and assimilation of technological processes that are new in principle. Envisaged is, above all, an incentive for the job leaders, but also for the workers who have directly participated in the creation and assimilation of these kinds of technology and technological processes. It is also essential that the source of the premiums mentioned be established--the means of the unified fund for the development of science and technology. At the present time, a proposal is being elaborated concerning the procedure for payment and the dimensions of these premiums.

The practical realization of a broad complex of measures to perfect the management of scientific-technical progress will guarantee a new powerful increase in the Soviet economy, a further increase in the well-being of the people.

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CSO: 1820

PRICES IN REGIONAL INTERSECTOR BALANCES

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian No 5, Sep-Oct 79
pp 951-960

[Article* by V. I. Suslov, Novosibirsk; submitted 4 December 1978]

[Text] The technique of measuring the initial data may predetermine to a considerable extent the goals and methods of the analysis to be conducted and the type of mathematical-economic model used in the analysis. This article discusses spatial intersector models for which regional coefficients of material costs are used as the principal initial data element. Regional intersector balances are taken as the source from which these cost coefficients are obtained, and the type of prices used in the regional balances serves as the technique of measuring them.

The purpose of this article is to establish the interrelationship between the type of prices in regional intersector balances (the technique of measuring the initial data) and the type of models oriented toward the use of coefficients of material costs.

Reasons for Existence of a Functional Relationship Between the Type of Prices and the Type of Model

The use of prices of different types in intersector balances gives rise to different coefficients of material costs in numerical terms. There is an especially high dependence on the technique of measuring regional coefficients in value terms. When the transition is made from one type of prices to another, the cost coefficients of "open" regions may change by a double-digit factor. This could considerably affect the solution of the spatial intersector problem in which these cost coefficients are used as the initial data. Nevertheless, the matrices of the coefficients of material costs remain similar in different prices, i.e., one is transformed into the other according to the formula: $A' = PAP^{-1}$, in which P is the diagonal matrix of index numbers for converting the prices of matrix A to the prices of matrix A', the solutions of the spatial problem remain identical up to the accuracy

* The article is meant to pose the problem.

of this conversion, and the problem of correspondence of the type of prices to the type of model does not arise.

Matrices of coefficients of material costs possess the property of similarity only within the limits of one type of prices. If this changes, there is a change in the matrices of the physical composition of the rows of the transportation sector and certain other sectors (trade, procurement, material and technical supply), and therefore they cannot remain similar. Changes in the cost coefficients of these sectors when the transition is made from one type of prices to another are related to the difference in the technique for recording the output of these sectors in prices of a different type. For example, the coefficients of transportation costs in prices of consumers include expenditures for delivery of the product produced to the consumers, while in the prices of producers they include expenditures for delivery of raw materials for production. The question thus arises of which type of prices to use to obtain "correct" results for realization of this model, or conversely, what spatial intersector model is induced by the given type of prices?

Criteria of the Correspondence of the Type of Model to the Type of Prices

The prices used in regional intersector balances depend as a rule on certain sectoral and regional proportions. To be specific, consumer prices for products produced in a region depend on its distribution among consumer regions, while producer prices for products consumed in a region depend on its distribution among supplier regions. If sectoral and regional proportions determining the prices which are its point of departure are not stated in a model's constraints and unknowns, then these proportions--and in turn prices--may change in the process of the model's use. Moreover, the proportions of production and consumption in value terms will prove to be "dislodged" from the corresponding proportions in physical units of measurement, i.e., achieving balances of product production and consumption in value terms does not ensure balance in physical terms. It is an indispensable and sufficient condition of the invariability of initial prices within a particular model that the same price be used to measure (in the base information) all components of each equation concerning distribution of the product (i.e., one and the same price is used in the row of each product's distribution).

Every equation on distribution of the product in any spatial intersector model can ultimately be represented in the form ("^" is the symbol indicating that value units of measurement are used):

$$\hat{x}_i^r = \sum_t \hat{\xi}_{it}^r, \qquad (1)$$

where $\hat{x}_i^r$ is the volume of production of the product i in the region r, $\hat{\xi}_{it}^r$ are volumes of consumption of the product for all possible purposes (these indicators vary from model to model). We will divide both sides of (1) by the volume of production in physical terms x_i^r, arriving at an

expression for the price of the product i in the region r: $p_i^r = \sum_t \xi_{it}^r / x_i^r$.

If one and the same price is used to measure every indicator ξ_{it}^r, then p_i^r, which is equal to it, does not change. If the prices of the indicators ξ_{it}^r are different, then p_i^r is a weighted average and may change with a change in the relations between these indicators.

In other words, when the relationship (1) is satisfied, it does not necessarily follow that the analogous relationship in physical terms is satisfied if different prices are used to measure individual components.

The requirements of stability of cost coefficients within the mathematical-economic models and use of the same prices in the rows of a product's distribution in intersector balances are well known, though not all economists acknowledge their validity. The simple arguments given above merely confirm the validity of these requirements. Nevertheless, the question of the correspondence of a particular type of prices in intersector balances to the specific type of intersector model has not been raised in the literature on the intersector balance and intersector models. It is usually assumed that when any intersector model is used it is more correct to use producer prices for the specific reason that cost coefficients in these prices are stable and these prices do not change in the rows of product distribution. This opinion is based on the a priori hypothesis that there are no regional differences in producer prices. This hypothesis was explicitly formulated, for example, by V. V. Kossov [1, p 147].

For the intersector balance of the country as a whole the hypothesis of the absence of regional differences in producer prices has certain foundations, but from the standpoint of spatial analysis, it seems too much to take for granted: there are regional differences both in consumer prices and also producer prices. Even though the fact of regional price differentiation is obvious, little attention has been paid to the problems which this fact creates for estimation of output in regional balances. Yet it is the existence of interregional price differences that determines the specific nature of the problems of estimating output in a regional balance as compared to a balance pertaining to one specific point. Regional price differentiation results from many factors, and its character is extremely complex.

The System of Regional Prices

The existence of space intervening between production and consumption gives rise to the possibility of using different prices to measure products produced and consumed in each region; both the prices of the product produced and the prices of the product consumed may figure as producer prices or consumer prices. Thus for each type of product in the region there are four basic price levels: consumer and producer prices of the product consumed and consumer and producer prices of the product produced. If the product is aggregated on a regional or sector basis, then these basic price levels may become "greatly blurred" and analysis of the reasons for the difference between them will become considerably more complicated. Hereafter, then, we

assume that the product is not aggregated either on the sector or the regional basis or that the criterion of aggregation is very rigid (aggregated products are homogeneous in production, consumption and transport).

Under the conditions of this hypothesis every spatial intersector model is constructed in one and the same classification of sectors and industries and regions on the basis of initial information in both value and physical terms. As a function of this characteristic we will refer to the model as "value" or "physical"; the former is appropriate to the type of initial prices if and only if its solution is the value expression of the solution of the corresponding "physical" problem.

If the turnover tax is included in the price of the product, then on the one hand there must be several consumer prices for one and the same product consumed in the region, since the rates of the turnover tax are differentiated according to types of use. On the other hand the consumer price of the product produced will be dependent on the structure of that product's distribution among types of use and ultimately on the sectoral structure of production, which precludes the possibility of building an intersector model appropriate to such prices. For that reason we assume that the turnover tax has been eliminated from the prices.

By definition producer prices do not depend on the location of possible consumers, and therefore the producer price of a region's entire output of a particular product is the same. In the subsequent analysis we will assume that this condition is fulfilled for consumer prices as well, i.e., that consumer prices of a region's total consumption of a given product are the same regardless of the suppliers of that product. This attribute of consumer prices is fairly realistic; to be specific, it must be fulfilled if interregional deliveries of products have been optimally organized. We will demonstrate this.

Consumer prices are by definition equal to producer prices plus shipping (commercial and transport) expenditures to deliver the product to the consumer, and they will therefore be dependent on the location of possible suppliers. There may be several consumer prices of products consumed in the region depending on the number of supplier regions. But if we assume that interregional deliveries of the product have been optimally organized, then situations of a plurality of consumer prices of a product used in the region cannot arise (this does not apply to plurality of supplier regions). As a matter of fact the supplier region to which the higher consumer price of a product consumed in a given region pertains (i.e., which has a higher total for the producer price and unit shipping expenses to deliver the product to the given region) is not advantageous and should be eliminated from the delivery plan if that plan is optimal.

This last assumption pertains to shipping costs to deliver a product produced to a consumer within the region. These shipping costs are taken either at zero, or it is assumed that they have been included in the producer

price as manufacturing costs. Then consumer and producer prices of products produced and consumed within a single region turn out to be the same and equal by definition to the price franco the consumer within the region. By force of the assumptions made above it is at the same time ensured that consumer prices of products consumed in the region will coincide with producer prices of the products produced. Thus in the situation under consideration there will be only three basic price levels for each product in the region: producer prices of products consumed, the price franco the consumer within the region and consumer prices of products produced in the region.

Thus three assumptions have been made concerning the attributes of prices: a) the prices do not include the turnover tax; b) consumer prices are uniform for each product consumed in the region and do not depend on the supplier region; c) shipping costs to deliver the product to the consumer within the region are either zero or are included in the producer price as manufacturing costs. In this case the price system of products which have not been aggregated on a regional or sectoral basis prove to be extremely simple. Each region is characterized by a single price for each product franco the consumer within the region, which at the same time is the consumer price for the entire output consumed in the region and the producer price for the entire output of the particular product produced in the region. We will call it simply the region price.

Prices not only of the region in question, but also of other regions are used in estimating output in an intersector balance of a region. For instance, producer prices of a product consumed are the prices of the supplier regions, and consumer prices of a product produced are the prices of consumer regions. The attributes of the system of regional prices constructed are largely analogous to the characteristics of the system of optimum estimates of output in certain regional-industrial models: for example, [2].

Aside from the three basic price levels for measuring output, two others are used in the regional intersector balance: prices franco the region's border for incoming and outgoing products. They arose from the practice of constructing retrospective intersector balances of the union republics. Within the limits of the assumptions we have made, the price franco the border for an incoming product is less than the region's price by the amount of shipping costs related to delivery per unit of the product from the border of the region to the consumer within the region; the price franco the border on outgoing products is higher than the price of the region by an analogous quantity.

Now that we have straightened out the system of regional prices we can undertake to construct spatial intersector models corresponding to a specific type of prices of regional balances. In order to build a model compatible with a given type of prices we must, as indicated above, set forth the regional and sectoral proportions determining those prices.

Spatial Models Corresponding to Certain Types of Prices of Regional Balances

Mixed Consumer Prices. In a regional balance in these prices all figures in each row for distribution of output, except for products coming in and going out of the region, are given in the single price of that region, which in this case figures as the consumer price of the product consumed. Export and import are measured in prices franco the border of the region, which differ from the region prices, thus giving rise to a price difference in the rows of the balance. All shipping costs related to deliveries within the region of products imported and produced (including exported) and also products crossing the region in transit are taken into account for each product in the transportation row.*

Thus volumes of production in value terms in these balances include quantities not related to volumes of production in physical terms of measurement: specifically--shipping costs for imported and transit products. One way of guaranteeing the stability of these "prices" and consequently of the cost coefficients of such balances is to determine the regional structure of production and interregional deliveries for each product. As a result we obtain the model:**

$$(L^r - A^r)x = Y^r, \qquad r = 1, \ldots, m, \tag{2}$$

in which L^r is a diagonal matrix whose elements show what share of the product produced in the country as a whole is consumed in the region r; A^r is a matrix of coefficients of the material costs of the product of region r relative to the country's total production; x is the vector of total volumes of production for the country; Y^r is the vector of final use of the product in the region r (vector of the final product without the net export-import result); m is the number of regions.

The matrix of this model is orthogonal, and its dimensions are mn x n (n is the number of sectors). Provided the territorial structure of production and interregional deliveries of every product is unchanging, the model can be used to solve two basic problems: determination of the final use of the product in each region for given volumes of production in the country as a whole, and, conversely, determination of volumes of production for the country as a whole and final use of the product by regions assuming a given final use in some one region.

Model (2) may be both "physical" and also "value." In the latter case the single price of the given region, which is the consumer price for the product

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* For more detail on accounting for shipping costs in the figures of intersector balances, see, for example, [3-4].

** Here and below we introduce constraints only for production and distribution of the product. Other constraints (resource scarcities, certain variables, and so on) may exist in models, but they are not essential from the standpoint of the purposes of our investigation.

consumed figures on the row showing distribution of every product in the region. Aggregate volumes of production for the country are measured in consumer prices, and therefore if we add up the interrelations of the model for all regions, we obtain the point model of the intersector balance for the country as a whole in consumer prices.

It can be said that the use of mixed consumer prices makes it possible to take only the first step from point analysis to spatial analysis: in the model appropriate to these prices only consumption is spatially represented; production is given in total volumes for the country.

Consumer Prices. In a balance composed in these prices all figures in each row of product distribution, except for exports, are measured in the unified price of the given region, which, as in the previous case, is the consumer price for products consumed. Exports are given in prices of other consumer regions and therefore differs from the price of other figures in the row of product distribution. Costs related to delivery of the product produced in the region to all consumers are taken into account in the transportation row for each product. Consequently, prices of the product produced (as well as of the product exported) are average weighted prices of consumer regions.

To ensure the stability of these prices and coefficients of material costs, it is sufficient to determine the structure of the distribution of the product produced in each region among consumer regions. This model takes the form:

$$\sum_s L^{rs}x^s - A^r x^r = Y^r, \qquad r = 1, \ldots, m, \tag{3}$$

in which L^{rs} is a diagonal matrix whose elements show what part of the product produced in the region s is consumed in the region r; A^r is a matrix of coefficients of the material costs of the region r; x^r is the vector of volumes of production of the region r.

Producer Prices. When regional balances are composed in these prices, the prices may vary considerably across the rows of product distribution, since the prices of other consumer regions are used in these balances to measure the product consumed in the given region. Therefore the prices of the product consumed are average weighted prices of supplier regions and may change. The output produced is determined in the prices of the given region, which in this case figure as producer prices of the product produced. To ensure stability of cost coefficients in such prices it is sufficient to determine the structure of distribution among supplier regions of the product consumed in each region for each individual type of use. If these distribution structures are determined, we obtain L. Moses' model:

$$x^r - \sum_s A^{rs}x^s = \sum_s L^{rs}Y^s, \qquad r = 1, \ldots, m, \tag{4}$$

in which A^{rs} is the matrix of coefficients of the physical inputs of region r's product for production of output in the region s, $\sum_r A^{rs} = A^s$; L^{rs} is a diagonal matrix whose elements show what share of the final use of the product in the region s comes from production in the region r.

The matrices of models (3) and (4) are square matrices with the dimensions mn x mn; their inversion yields two types of coefficients of full material costs. These models can be used to solve the same problems: to determine final use of the product in regions for given volumes of production or the volume of production in regions for a given final use of the product. Of course, the solutions obtained with (3) or (4) will be different, since the initial premises of the models are not the same.

Models (3) and (4) may be both "physical" and also "value." In the latter the unified price of the given region is used on the rows for distribution of every product in the region; for model (3) this price is the consumer price for the product consumed, while for (4) it is the producer price for the product produced.

The results obtained allow us to conclude that the transition from mixed consumer prices to consumer prices or producer prices is the next step after the shift from point analysis to spatial analysis. Balance models in which both consumption and production are spatially represented are appropriate for these prices.

Input coefficients of intersector balances in consumer prices or producer prices cannot be used directly in spatial analysis for the purpose of optimalization, since in these balances either the product produced or the product consumed is measured in prices of "someone else" (prices of other regions), which makes the partial operation of regional proportions in the process of analysis indispensable. This was demonstrated above. Optimization analysis is possible on the basis of input coefficients of regional balances in which only "own" prices are used to measure all indicators. Such balances are not constructed for practical purposes and have not been studied theoretically in the literature on intersector balances, though it is they which possess the best analytical potential. The intersector balance of a region all of whose indicators are measured in the prices of that region is obtained when prices franco the consumer within the region are used.

Prices Franco the Consumer Within the Region. The intersector balance in these prices can be obtained with comparative ease from the balance in mixed consumer prices or in consumer prices. For example, it is sufficient to exclude from the column of exported output in the second section and from the transportation row in the first section of the balance in consumer prices the shipping costs related to shifting the exported product from internal to external consumers (these costs will remain in the transportation row within the second section as exports of the region's transportation output). All

figures in each row of product distribution, including export and import, will consequently be measured in the prices of the given region (in prices franco the consumer within the region); the output produced in the region is measured in those same prices.

Prices franco the consumer within the region do not depend on any sort of regional proportions of production or distribution, which is why they are the "own" prices for each region. That is why spatial models whose variables are determined by a rather broad spectrum of regional proportions can be appropriate only to those prices or prices possessing the analogous properties of independence from regional proportions. We will illustrate this with the example of one class of spatial intersector optimalization models.

We will take this model as our point of departure.

$$(E - A^r)x^r + \sum_{\mu\nu\in\Omega_r} C_r^{\mu\nu}x^{\mu\nu} - Y^r \geq 0, \qquad r = 1, \ldots, m \tag{5}$$

in which Ω_r is the set of pairs of regions between which product deliveries "affect" the region r (the region r is either the exporting region, if $\mu = r$, or the importing region, if $\nu = r$, or the transit region for delivery from the region μ to the region ν, if $\mu, \nu \neq r$); $C_r^{\mu\nu}$ is an $n(n-1)$-matrix whose last row (it is assumed that transportation is the last item in classification of sectors) shows with a minus sign coefficients of transportation costs of the region r to deliver the product from the region μ to ν, while the remainder of the matrix is either $-E_{n-1}$, if $\mu = r$, or E_{n-1}, if $\nu = r$, or O_{n-1}, if $\mu, \nu \neq r$; $x^{\mu\nu}$ is the $(n-1)$-vector of product deliveries from region μ to ν.

The forms of representation of final use of the product Y^r, other interrelationships of the model and the optimality criterion are not specifically given in (5). They may be different in various specific models. From the standpoint of the purposes of this article it is only important that the variables of product deliveries are not involved in other interrelationships of the model and in the optimality criterion. A detailed description of models of this class has been given elsewhere [2]. These models are used to solve a broad range of problems in optimalizing regional proportions, including those set forth in [2-4]. Model (5) can be both "physical" and "value." The transition from the former to the latter might, for example, be done as follows.

Suppose P_r is a diagonal (n x n) matrix of prices of the region r; $\bar{P}_r$ is the part of that matrix whose dimensions are $(n-1) \times (n-1)$ from which the last rows and columns, pertaining to transportation, have been omitted. We multiply both sides of (5) from left to right by P_r, and we substitute the variables: $x^r = P_r^{-1}P^r x^r = P_r^{-1}\hat{x}^r$, $x^{\mu\nu} = \bar{P}_\mu^{-1}\bar{P}_\mu x^{\mu\nu} = P_\mu^{-1}\hat{x}^{\mu\nu}$. As a consequence we obtain the "value" model pertaining to the variables $\hat{x}^r$, $\hat{x}^{\mu\nu}$, in which, to be specific, $\hat{A}^r = P_r A^r P_r^{-1}$,

$$\hat{C}^{\mu\nu}_{\nu} = P_{\nu} C^{\mu\nu}_{\nu} \bar{P}^{-1}_{\mu}. \qquad (6)$$

The optimum plan of the "value" model obtained is by virtue of the structure the value expression of the optimum plan of the "physical" model, and consequently (5) corresponds to the prices P_r. The same prices P_r are used in (5) to measure all terms of each equation of product distribution, including imports and exports, which is possible only in the case when they are prices franco the consumer within the region.

Cross Hauls in the Optimum Plan of the Spatial Model

The absence of cross hauls of the product ${}^{T}X^{\mu\nu}X^{\nu\mu}$ is an attribute of the optimum plan of the model (5). As a matter of fact, $u^{\nu}_{i} > u^{\mu}_{i}$ (optimum estimate of output in the consumer region strictly greater than in the producer region) is an indispensable condition for existence of the delivery $X^{\mu\nu}_{i}$ of the product i in the optimum plan of the model (5). This follows from the well-known conditions of complementary nonrigidity of solutions of the one-way and two-way problems.* Then the attribute we have noted follows from the fact that the inequalities $u^{\nu}_{i} > u^{\mu}_{i}$ and $u^{\mu}_{i} > u^{\nu}_{i}$ are mutually exclusive. The absence of cross hauls is natural for optimum plans of unaggregated models. But it is undesirable for this condition to be met for optimum plans of aggregated (by sectors) "value" models, since in reality the existence of cross hauls of aggregated products is more the rule than the exception.

Aggregation of the model (5) in the prices franco the consumer within the region which are appropriate to it ensures the possibility of the existence of cross hauls of the product in optimum plans of the aggregated models obtained. We will demonstrate this.

The "value" and "physical" models (5) differ from one another not only in the technique for measuring the initial data, but also in their structure. Thus it follows from (6) that in the restrictions on distribution of the product of the "value" model (5) the coefficients when there are changes in imports are not equal to unity, as in the "physical" model, but to index numbers for converting the prices of the exporting region to the prices of the importing region, which are equal to unity only when there are no interregional price differences. This structural attribute of the "value" model must be retained even after aggregation. We will indicate as $\pi^{\mu\nu}_{i\nu}$ the elements of the aggregated diagonal matrix $\bar{P}_{\nu}\bar{P}^{-1}_{\mu}$ (part of the matrix $\hat{C}^{\mu\nu}_{\nu}$). This notation $\pi^{\mu\nu}_{i\nu}$ represents the average index numbers for conversion of the prices of the region μ to the prices of the region ν for deliveries of the aggregate i from region μ to region ν. Then cross hauls of the aggregated product i between the regions μ and ν can simultaneously exist in the optimum plan of the aggregated model, since the inequalities $u^{\nu}_{i}\pi^{\mu\nu}_{i} > u^{\mu}_{i}$ and $u^{\mu}_{i}\pi^{\nu\mu}_{i\mu} > u^{\nu}_{i}$ do not exclude one another. The latter follows from the fact that the equality $\pi^{\mu\nu}_{i\nu}\pi^{\nu\mu}_{i\mu} = 1$ need not as a rule be fulfilled, since the intrasectoral structure

* It is assumed that in every case of interregional product deliveries there is at least one nonzero coefficient of shipping costs and that optimum estimates of transportation output are not equal to zero.

of cross hauls for the aggregate i should differ (otherwise they make no sense).

Cross hauls of products in the optimum plans of aggregated models must be absent if those models are constructed on the basis of inappropriate prices: for example, consumer prices or producer prices. This inappropriateness arises in model (5), specifically because the relevant prices are the same for products shipped both in the supplier region and also in the consumer region. Therefore the use of these prices in constructing the aggregated model (5) results in a "value" model that is structurally similar to the "physical" model in whose optimum plans cross hauls do not exist.

Thus we have examined in this article the correspondence of the type of prices of regional intersector balances to the type of spatial intersector model. The results obtained allow us to state that this problem has come about not only and even not so much from a desire to obtain statements of the problems of spatial intersector analysis which are irreproachable from the methodological standpoint. Ignoring this problem results in serious and systematic errors in the results of the analysis such as the absence of cross hauls in optimum plans of spatial models. At the same time prices are only one aspect of measurement of regional coefficients of costs. The technique for measuring cost coefficients is also determined by the methods of recording output (gross output or gross turnover) and by the principles governing aggregation of sectors and by the general conception of the structural scheme of the intersector balance (the physical-value balance or the balance by "pure" sectors), and so on. The question of what method or which structural scheme of the intersector balance is best for use in a particular case can be answered only as a result of a serious analysis of the problem of the correspondence of the technique for measuring the initial information to the goals and methods of the analysis to be conducted.

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